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Self-healing Concrete with Superabsorbent Polymers for a Sustainable Future

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Concrete is an excellent material to take up compressive forces. However, due to the low tensile strength, concrete is very brittle. When tensile forces are acting, the concrete may crack. This cracking leads to the ingress of water, and with that, to the ingress of potentially harmful substances. In this way, the durability of concrete is endangered. If you do not repair it in time, the costs will rise sky high. But, how can we solve this? Using a self-healing concrete is the solution but it needs to be improved. A novel self-healing material was design using synthetic microfibers and superabsorbent polymers. The microfibers are used to limit the crack width, leading to strain-hardening cementitious materials. Next, water can be provided by the use of superabsorbent polymers, which are extracting moisture from the environment, even when not being exposed to rain. This moisture is used to promote and stimulate autogenous healing and leads to a complete regain in mechanical properties. The material is able to visually heal itself perfectly and was studied using various high-tech equipment. To a certain degree the autogenous healing capability of cementitious materials is maintained during subsequent loading cycles. The superior self-sealing and self-healing capacity improves the reliability and the lifetime of structures, reducing the overall repair and maintenance costs. In this way, an innovative smart self-healing cementitious material which is reliable and independent from the conditions is acquired. The smart cementitious material with superabsorbent polymers may thus be an excellent material to use in future building applications.